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BANGALORE, SATURDAY 24TH AUGUST 1867.

MISCELLANEOUS PAPERS.

CHINCHONA.

Report on the results obtained in an analytical examination of the Chinchona of the Madras Government plantations, in continuation of page 11 *of report published in the first Supplement of the Mysore Gazette, dated 3rd August* 1867.

Letter No. 533, from J. Broughton, Esq., Quinologist to Government, to the Secretary to Government, Revenue Department, Fort Saint George, dated Ootacamund, 13th July 1867:—

1. I beg permission to complete in the subsequent pages, the account of the results obtained in an analytical examination of the Chinchona of the Government plantations, the earlier part of which I had the honor of communicating in my report, dated 1st April 1867. This examination was absolutely required, in order to obtain as far as possible a knowledge of the existing conditions under which future work will have to be conducted.

2. It is for this reason also that I have paid special attention to the products of the chinchona barks while in their fresh, green state, before being subjected to those processes of drying and transit, which I have reason to think considerably modify their chemical nature. By having the plants themselves so near at hand I possess a great advantage, which will not fail to lead to valuable results.

Bark in its fresh state.

3. In the report above referred to, I had the honor of quoting some analyses of one of the varieties of crown barks, namely that of *C. officinalis* var. *Bonplandiana*. We possess, however, two other varieties of chinchona officinalis, respectively named vars *Condaminea* and *Crispa*, and it appeared desirable to make a comparative examination of the bark of each under similar conditions of age, locality, elevation, &c.

Crown Barks.

4. Analyses of two samples of the trunk bark of var. Bonplandiana, of three years eight months old, from Doddabet plantation, and grown on grass land, yielded the following results, calculated in per centages of dry bark:—

C. Officinalis var, Bonplandiana.

Statement of Analyses.

	I	II
Total alkaloids	3·84	3·91
Quinine	1·64	1·83
Chinchonidine and Chinchonine ...	2·20	2·08
Sulphate of Quinine obtained crystallized.	1· 5	1·61
Sulphate of Chinchonidine obtained crystallized	1·74	1·80

The thickness of the finer specimens of this bark was about 0·12 inch. It contained an average of 73 per cent of water.

5. An analysis of the bark of *C. officinalis* var. *Condaminea* yielded the following numbers:—

Var Condaminea.

Statement of Analysis.

Total alkaloids	4·08 per cent.
Quinine	2·05
Chinchonidine...	2·03
Crystallized Sulphate of Quinine obtained	1·54
do. do. of Chinchonidine obtained	1·70

The amount of water in this bark was 73 per cent. For this fine variety of crown bark this country is indebted to Mr. Howard.

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Var Crispa.

6. Analyses of the bark of *C. officinalis* var. *Crispa*, grown on grass land of the same age as the preceding varieties, yielded in per centages of dry bark:—

Statement of Analyses.

	I	II
Total alkaloids	3·72	3·81
Chinchonidine and Chinchonine... ...	1·42	1·54
Quinine	2·30	2·27
Sulphate Chinchonidine obtained crystallized...	0·80	0·87
Sulphate Quinine obtained crystallized ...	1·95	1·75

Other determinations of the gross amount of alkaloids in this variety of bark yielded respectively 3·31 per cent, 3·70 per cent, and 4·1 per cent. The mean of results being, therefore, 3·73 per cent.

Discrepancy with Mr. Howard's analysis.

7. From a report on this bark by Mr. Howard, dated February 1867, I observe that he arrives at very different conclusions respecting its value.* I have, however, spent much time in carefully verifying the grounds of my opinion, and have no hesitation in affirming that this variety of crown bark is not essentially inferior in its yield of alkaloids to the other two. I believe the great discrepancy between Mr. Howard's analysis and my own, can be explained either by an unfavourable specimen of bark reaching him, or more probably by the quality being deteriorated by the mode of drying. It will also be observed that this bark contains chinchonidine and not quinidine. This result I have carefully corroborated by obtaining all the characteristic re-actions of chinchonidine. In examining its solution by polarized light, I obtained a strong rotation of the plane of polarization to the left and not to the right, as in the case of quinidine. The re-actions of quinidine I failed to obtain. I have the honor to forward a specimen of pure sulphate of quinine obtained from this bark.

Similarity of Crown Barks in yield.

8. From the above data I am compelled to conclude that there is scarcely any difference of yield in the three varieties of C. officinalis as grown on the Government plantations. I would place little stress on the variations in the amount of chinchonidine, as indicating a constant peculiarity in either kind. It is very remarkable that the specimens of the bark of var. Bonplandiana, which were one year older than those whose analysis is above given, and which were grown under partial shade, yielded little of this alkaloid, a circumstance which I had the honor of mentioning in a former report.*

Chinchonidine in Indian Barks.

Dr. deVrij found that the calisaya barks of Java were somewhat similarly affected, and contained more quinine when grown under partial shade. I think there are grounds for believing that when the branches of our trees are sufficiently expanded to screen their bark from direct sun light, the amount of chinchonidine in these barks will be found to diminish. The substitution to a greater or less extent of quinine by chinchonidine is a very general characteristic of all our best barks, though the range of replacement is wider in the red.

Value of Crown Barks.

9. For the manufacture of pure crystalline salts of the alkaloids, the varieties of C. Officinalis yield the most suitable barks in our possession. Their alkaloids crystallize as sulphates with singular ease, and are readily purified. The very considerable yield of such young trees (three years eight months) is worthy of special remark.†

Similarity of Botanical structure.

10. The similarity in the amount of alkaloids yielded by the crown barks is in harmony with the similarity of their botanical structure. The three varieties resemble each other so greatly, that except in the case of individual plants, which possess in a special degree the attributed marks of their variety, it is very difficult to distinguish them with certainty. They are all mingled on the plantations. Had it not been for the kind and valuable assistance I have received from Mr. Bat...ck, who has taken much pains to select me specimens of undoubted origin, it would have been scarcely possible for me to have made the comparative examination I have had the honor to cite.

Leaves.

11. I have also made a careful investigation of the leaves of C. Officinalis. I worked with 3 lbs. of the fresh leaves; but, though a considerable precipitate was at first obtained, I was finally unable to detect even a trace of alkaloid. I conclude, therefore, that the leaves of this species are destitute of value.

Fruit.

12. A similar examination was made with the ripening fruit. In this case I succeeded in obtaining indications of alkaloid; but the amount was so minute that although I worked with a large quantity of the fruit, I was unable to determine its nature with certainty, nor did the most delicate tests for quinine indicate that sub-

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* "No. 8. *C. Officinalis* var. *Crispa*.—Original bark unmossed.
Crystallized sulphates ... 0·259
Alkaloids soluble in Ether ... 0·370
Insoluble in Ether, chinchonicine a trace ... ...
0·629" P. 2 of Report.

"It must be evident that the var Crispa should not be propagated, as it will not repay the expence of cultivation."—*Ibid* P. 3.

* Proceedings of Madras Government, Revenue Department, No. 206, 12th April 1867.

† Since the above was written, I have obtained as much as five per cent of alkaloid from trees of the same age, growing under very favourable conditions of soil, aspect, &c.

stance. The fruit certainly contains less than 0·00002 per cent of its weight of dubious alkaloid, and is practically worthless for officinal preparations.

13. I have already had the honor of communicating the results of an analysis of the bark of C. *Micrantha*.*

C. Nitida.

14. An analysis of the trunk bark of C. Nitida, four and a half years old, from Neddivuttum, gave the following per centages of alkaloid calculated for dry bark :—

Total Alkaloids	6·00 per cent.
Alkaloid soluble in ether ...	0·32
Chinchonine	5·54
Quinidine	0·14
Crystallized sulphate obtained	0·10

The bark was 0·17 inch thick, and contained 69 per cent of water. A microscopic examination shewed a great abundance of resin cells with but few cortical fibres. The chinchonine obtained, crystallized with readiness. This bark and its products shewed much similarity with those of C. Micrantha, though the alkaloids obtained were somewhat less in quantity. Six per cent is, however, a large yield, and is treble that of the American C. Nitida bark.

C. Peruviana.

15. The trunk bark of C. *Peruviana* gave, on analysis, the following numbers calculated for one hundred parts of dry bark :—

Total alkaloids	6·25
Soluble in ether	0·41
Chinchonidine	2·00
Chinchonine	3·84
Crystallized sulphate chinchonidine obtained	1·80

The bark was 0·16 inch thick, and contained 72·9 per cent of water. It differs from the other Grey Barks by containing two per cent of Chinchonidine, differing in some respects from ordinary Chinchonidine, though its optical properties are apparently the same.†

Value of Grey Barks.

16. From the foregoing analyses appears that although the Grey Barks do not contain quinine, they are among the richest we possess in their yield of alkaloids. I would submit that the results obtained by the Chinchona Commission, respecting the efficacy of the alkaloids produced by these plants, hardly justify the disregard with which the Grey Barks have hitherto been treated. I would suggest that the cultivation of the beautiful leaved *C. Peruviana* might be extended, with considerable advantage in many cases. A few plants interspersed among future plantations of C. Succirubra would do much to relieve the monotonous uniformity of appearance produced by the latter.

"Unknown name" Bark.

17. An examination of the species of Chinchona that is designated "unknown name" yielded the following results. In the dry bark :—

Total alkaloids	1·2 per cent.
Alkaloid soluble in ether ...	0·39
Chinchonine	0·81
Crystalline sulphates	none.*

The bark contained 73·4 per cent of water. The alkaloids obtained are deficient in quantity, and are purified with extreme difficulty from the bitter resin with which they are associated. The amount of chinchonine that I was able to obtain in a crystalline state was small.

C. Pahudiana.

18. The cultivation of C. Pahudiana has long been abandoned. I made, however, for my own satisfaction an examination of the bark. From it I was only able to obtain 0·3 per cent of alkaloid. The bark of this species is thin, and a microscopic examination shewed that the fibres of the liber are more abundant and of larger size than those occurring in the more valuable kinds. Its structure presents few of the indications which are said to characterize the valuable kinds of chinchona.

C. Calisaya.

19. Among the unpromising looking bushes, which are our oldest representatives of the *C. Calisaya*, there are but three whose bark is available for analysis. As this kind has already been examined by Mr. Howard, and its cultivation discontinued, I thought it better to reserve the examination of these few trees till special circumstances may render it necessary.

Subjects in course of investigation.

20. Experiments are in progress for the determination of the best season for cropping the bark on the large scale, but some time must elapse before these are complete. Comparative trials of the various methods of drying the bark for exportation must be postponed, till the atmosphere is less saturated with watery vapour than it is at this season.

21. In addition to the results I have had the honor to communicate in the foregoing paragraphs, I have been fortunate enough to obtain some of interest connected with the influence of soil, and others relating to the physiology of the alkaloids and their occurrence. But until the application of these results has been verified by repeated experiments, I will, with

* Total alkaloids... ... ... 7·1 per cent.
Soluble in ether. ... ... 0·3
Chinchonine. ... ... 6·8
Crystalline sulphates.. ... None... Report, dated 1st April 1867.

† I believe with Mr. Howard, (Nueva Quinologia,) that this alkaloid is identical with that described by Wittstein. I am at present unable to refer to Wittstein's Memoir, which is necessary for complete confirmation.

* Since Chinchonine crystallizes more readily in the free state, I invariably exclude it from the sulphates.

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the permission of Government, refrain from communicating them.

22. I shall have the honor of communicating further information on the effects of mossing the barks of the various kinds, as soon as the trees I have thus treated have been allowed sufficient time to yield bark available for analysis.

Officinal preparation of C. Barks.

23. The question respecting a ready means of utilizing the barks in the form of some simple preparation for therapeutical purposes in this country is receiving my best attention.

No. 534. Order thereon—26*th July* 1867, *No.* 1,711.

1. Ordered that the above report be forwarded to the Secretary of State, together with the sample of pure sulphate of quinine obtained from the bark of *C. Officinalis* var. *Crispa*.

2. It is observed that the samples of alkaloids prepared from the Red Bark, and received with Mr. Broughton's first report, were similarly forwarded.

3. The present report will also be communicated to the Governments of India and of the other presidencies, and copies of both reports, together with that of the Chinchona Commission, will be forwarded to the Governments of Ceylon, the Straits' Settlements, Batavia, and the French Settlements in India.

4. The Government desire that attention be given by the Superintendent of the chinchona plantations to the more extended cultivation of the Grey Bark varieties, and that Mr. Broughton's suggestion for the intermingling of the *C. Peruviana* in future plantations of *C. Succirubra* be carried out.

5. It seems undesirable to extend the cultivation of the variety designated "*unknown name*" the bark of which appears to be comparatively valueless. The Government will look with interest for Mr. Broughton's further reports.

(True Extract.)

(Signed) W. HUDLESTON,
Secretary to Government.

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